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ASSIGNEE-INFORMATION:

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ABSTRACT:
A foam-cored sandwich panel has a fixing point 4 encapsulated in a portion 3 of the foam material, which portion 3 has a density higher than that of the remaining foam material 2. The portion 3 of foam material of greater density acts both as an anchor and a spreader of the load and the fixing preferably includes spreader means for distributing the load through the portion 3.

The fixing can be encapsulated in the portion 3 of foam material on one skin 1b of the sandwich panel any by holding a mould jig against a surface of the skin 1b, attaching the fixing 4 within the mould jig and introducing the foam of greater density into the mould jig to encapsulate the fixing 4 with the foam material 3. Thereafter, the jig is removed and the other skin 1a and material 2 of lesser density are secured in position.

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(54) Fixing into sandwich panels

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GB 2 068 831 A

Fig.1.

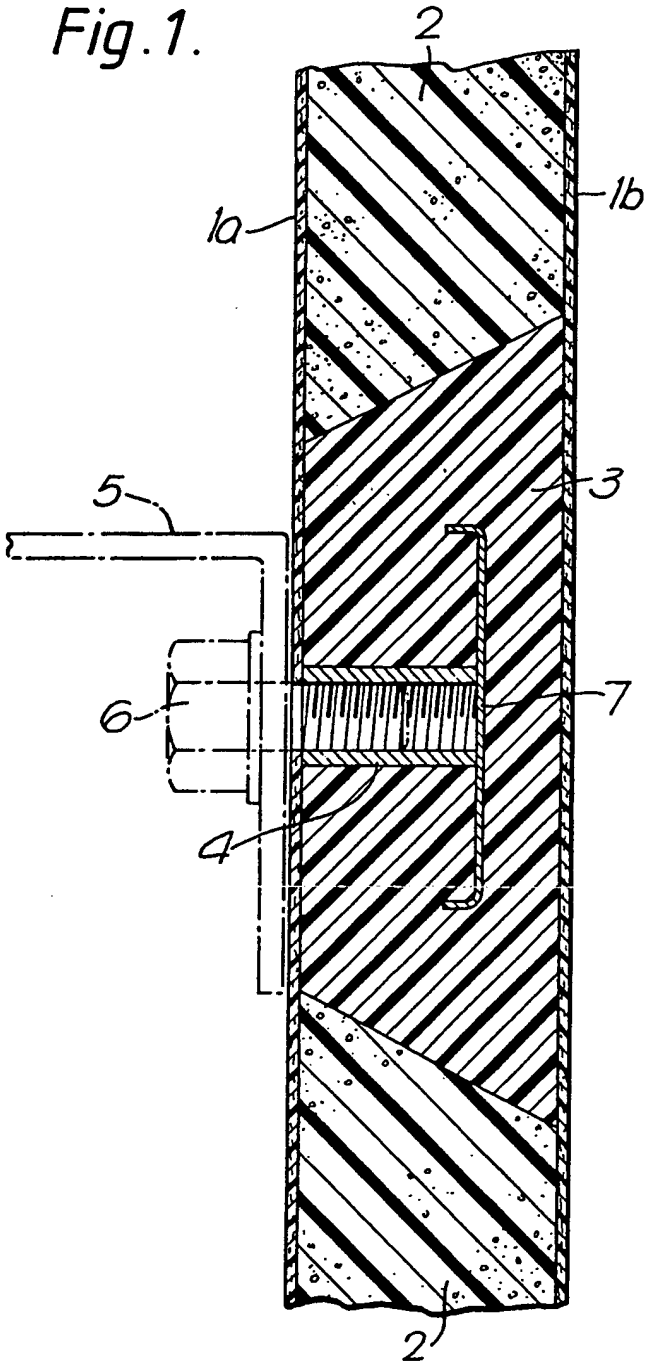


Fig. 2.

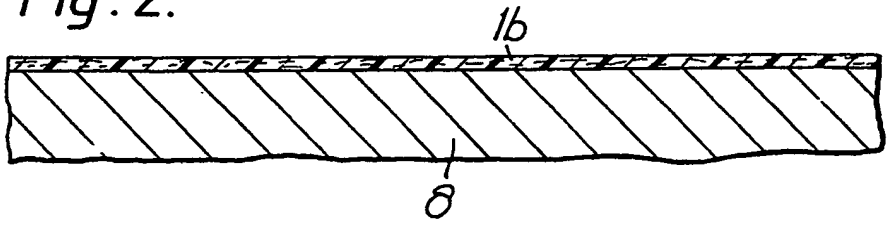


Fig. 3.

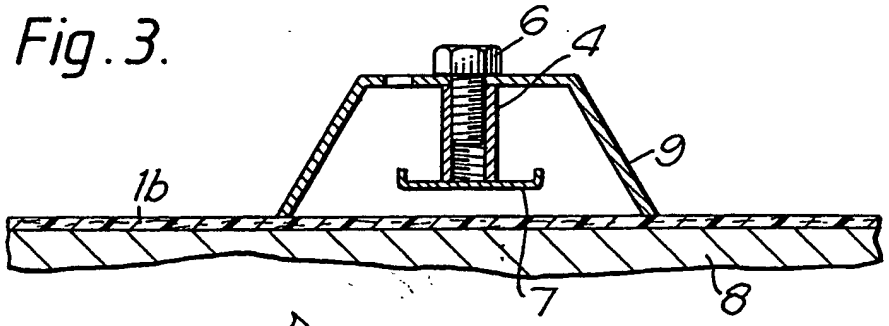


Fig. 4.

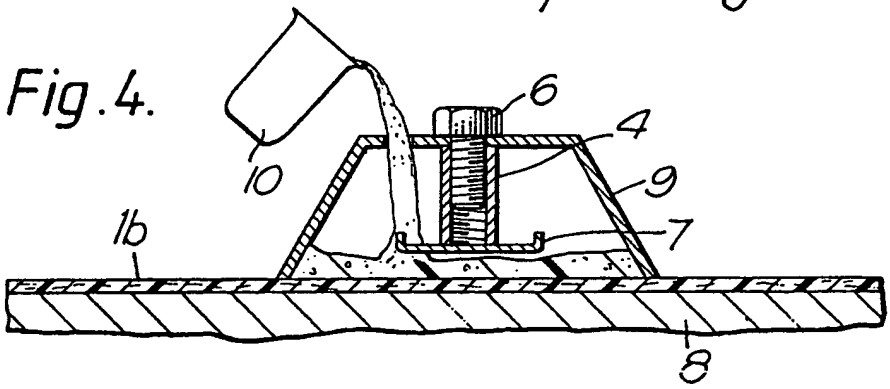


Fig. 5.

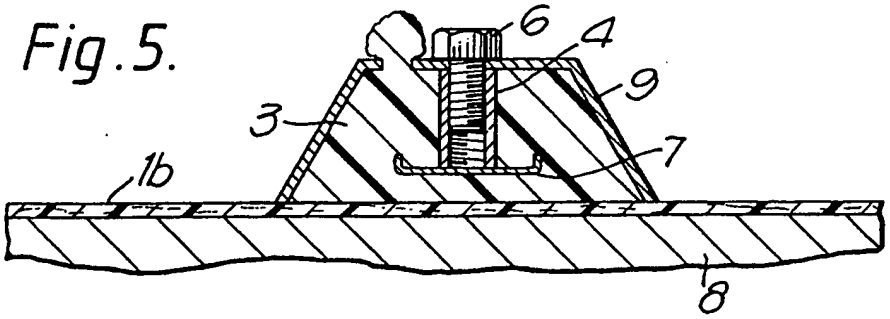
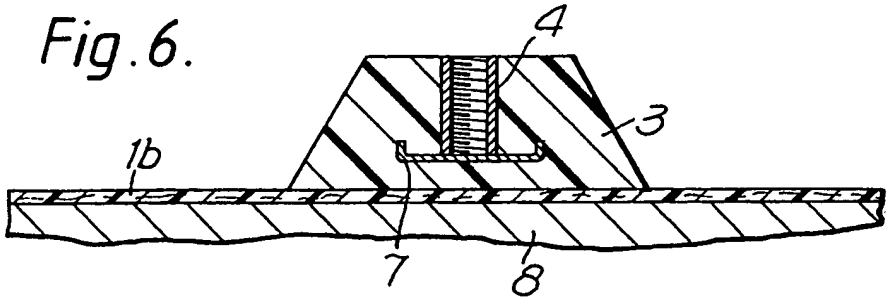


Fig. 6.



SPECIFICATION

Fixing int sandwich panels.

This invention relates to a method of making an attachment to a sandwich panel.

Foam-cored sandwich panels have high strength and stiffness combined with low weight and outstanding thermal insulation. These advantages make them very attractive for a variety of applications, in particular as external cladding to buildings. However, despite their high overall strength and stiffness, sandwich panels are not capable of carrying high concentrated loads because of the relatively low strength of the core material. Where significant concentrated loads are applied to the panel, some form of local reinforcement is necessary, and this usually involves the insertion of a block of solid material (usually wood or metal) between the skins of the sandwich in place of the core material. Solid inserts have a number of disadvantages, some of which are:–

1. They have to be prefabricated and are therefore expensive.
2. Matching insert thickness with core thickness is difficult.
3. They create local loss of thermal insulation (cold bridging).
4. Unless they are of the same material as the skins they can cause differential thermal expansion.
5. The sudden change in shear stiffness at the interface between insert and core can cause peeling of the skin away from the insert.
6. Bonding-in the insert can be difficult and time consuming.

According to this invention there is provided a design and a method of making an attachment point in a foam-cored sandwich panel, which is intended to avoid the disadvantages listed above.

This is achieved by having a fixing point encapsulated into a foam material of greater density than the foam of the core. The foam of greater density acts both as an anchor and as a spreader, but is not so different in its relevant physical properties from the remainder of the core that disadvantages such as those listed at 3 to 6 above recur. There is no separate prefabrication or problem of thickness matching because the fixing point can be encapsulated in situ on a first skin of the sandwich, probably using a separate mould jig to restrain the spread of high density material—th remainder of the core is added subsequently ither befor or aft r positioning of the second skin.

The fixing point may b of any sort, .g. an internally threaded sleeve for reception of a bolt, but preferably will hav spreader means to assure some degr e of load distribution through the higher density foam mat rial.

In the attached drawings, *Figure 1* is a section through a finished panel, and *Figures 2 to 6* show stag s in its production.

The principal features of th attachment point are shown in Fig. 1 attached, in which:–

In Fig. 1 two GRP skins of 1a, 1b of a sandwich panel are united by core material 2 (typically a thermosetting plastics foam). A moulded plug 3 of plastics foam of higher density than the core material encapsulates a fixing 4. The plug 3 is of tapered (frusto conical or frusto pyramidal) shape, with a wedge action in the direction of expected loads. The fixing 4 shown is a threaded metal tube welded to a metal plate 7. Other materials and types of fixing can be used equally well, as long as they incorporate some means such as a generous plate to spread the load into the foam plug 3. A steel angle 5 is the sort of member to which the panel might be fixed in practice, by means of a hexagon headed bolt and washer 6, screwed into the fixing 4.

It can be seen how the plug 3 spreads the loads received by the fixing and yet can be of a material physically compatible with the remainder of the core and with the functions of the panel.

Generally, the production technique used is as follows:

1. A layer of skin material is layed out on a flat surface, outside surface down.
2. A mould jig of suitable dimensions is pressed onto the skin at the point where the fixing point is to be made. The fixing is attached to the mould jig in the correct location.
3. A measured quantity of thermosetting foam of higher density than the sandwich core is mixed and poured into the mould jig.
4. The high density foam fills the mould jig and encapsulates the fixing.
5. The mould jig is removed, leaving the attachment point adhered to the skin material.
6. Manufacture of the sandwich panel is completed by adding the second skin and remainder of the core material, i.e. lower density foam, in whichever order is preferred.

It will be necessary to drill a hole in the skin 1a over the fixing. This can be done before or after the skin is attached.

The high density foam plug should be tapered so that tensile loads on the fixing are transferred from high density to low density foam by compression. This makes the process of load transfer more gradual and gives a higher load carrying capacity than a parallel-sided plug. It also makes removal of the mould jig easier.

A particular application will now be described in d tail, by way of exampl . This is the attachment point in a foam-cored GRP sandwich cladding pan l, which is r quired to resist tensile loads up to 1.7kN perp ndicular to th panel.

The procedure is as follows; referring to Figs. 2–7 attached:

1. The GRP skin 1b is laid up in a f mal mould or table 8 (Fig. 2).

2. While the skin 1b is still wet a mould jig 9 is coated internally with release agent and pressed onto the skin. It is located and held there by a clamp attached to the side of the mould 8.

A metal tube-and-plate fixing 4 is attached to the mould jig 9 (Fig. 3). It is temporarily plugged to avoid foam material entering it. When the tube of the fixing 4 is screw-threaded, a threaded bolt 10 may be used both to attach the fixing to the mould jig 9 and to plug the tube.

3. High density foam 10 (approximately 200kg/m³ cured density) is mixed and poured into the mould jig 9, (Fig. 4).

4. The foam expands to fill the mould jig and encapsulates the fixing (Fig. 5).

5. When the foam plug 3 is hard the mould jig 9 is removed, leaving the fixing point adhered to the skin 1b (Fig. 6).

6. Low density polyurethane foam (approximately 35 kg/m³ cured density) is sprayed onto the skin 1b to the required thickness within the mould 8, allowed to set and then planed off flush with the high density foam plug 3. GRP skin 1a is then laid-up onto the core and cured. This method of sandwich manufacture is the subject of our co-pending patent application No. 80.21455 (publication No. 2053785).

7. The skin 1a is drilled to give access to the fixing point 4, and the finished panel is removed from the mould 8 to yield the panel seen in Fig. 1.

CLAIMS

1. A sandwich panel including a pair of skins, a core of foam material between the skins, at least a portion of which foam material has a density greater than that of the remainder, a fixing point encapsulated within the portion of foam material of greater density and an aperture in one of the skins to allow access to the fixing point.

2. A sandwich panel according to claim 1, wherein the fixing point includes spreader means to provide load distribution through the foam material of greater density.

3. A sandwich panel according to claim 1 or claim 2, wherein the fixing point is a sleeve which is internally threaded for reception of a bolt.

4. A sandwich panel according to any one of the preceding claims, wherein the portion of foam material of greater density is of tapered shape with a wedge action in the direction of expected load.

5. A sandwich panel according to any one of the preceding claims substantially as her in d scribed and as illustrated with r ference to the accompanying drawings.

6. A method of providing a fixing point in a foam cored sandwich panel, which method includes encapsulating a fixing in a portion of the foam mat rial on one side of th panel, which portion is to be of a density greater than that of the remaining foam material and, in either order, providing the remainder of the foam material and securing the other skin in position, which other skin is provided with an aperture to allow access to the fixing.

7. A method according to claim 6, wherein the said step of encapsulating the fixing in the portion of foam material of greater density on the one skin of the panel is carried out by releasably holding a mould jig against a surface of the one skin, releasably touching the fixing within the mould jig, introducing the foam of greater density into the mould jig to encapsulate the fixing and releasing the fixing from the mould jig and leave the fixing encapsulated within the foam of greater density on the one skin.

8. A method according to claim 7, wherein the mould jig is of frusto-conical or frusto-pyrimidal shape to provide a wedge shaped said portion of foam material of greater density.

9. A method according to claim 6, claim 7 or claim 8, wherein the one skin is laid up in a female mould, and after said encapsulation of the fitting in the portion of foam material of greater density, the remaining foam material is introduced into the female mould and allowed to set.

10. A method according to any one of claims 6 to 9, substantially as herein described with reference to and as illustrated in the accompanying drawings.

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